

**FLOODS.**

Continuous heavy rain during the first few days of the month caused floods in parts of southern Missouri, eastern Arkansas, and northern and eastern Texas, which destroyed property to the value of millions of dollars; and during the first decade of the month heavy rain caused streams in central, southern, and western Illinois, and southern Indiana to overflow their banks, entailing considerable damage to farming and railroad property. Reports of the 15th and 16th stated that many of the smaller streams in western Pennsylvania and West Virginia were over their banks and doing much damage; and reports from Carini, Ill., dated the 16th, stated that a portion of that city was flooded and that lowlands were under water by an overflow of the Little Wabash River. A report from Eureka, Cal., dated the 13th, stated that in consequence of the continuous heavy rain the rivers in that vicinity were flooding the lowlands,

sweeping away bridges, and doing other damage, and a report from the same place dated the 24th stated that the Eel River had overflowed its banks, and that a considerable area of the valley was under water. On the 25th a portion of Los Angeles, Cal., was flooded by a rise in the Los Angeles River; portions of the levee were washed away and washouts occurred on the railroads. During the latter part of the month warm rains melted a large amount of snow in the Sierra Nevada and Sierran mountains in northern California, causing streams to overflow their banks, washing away railroad bridges and levees, filling cuts, flooding towns, and causing land slides. The damage was especially heavy in Sacramento, Sonoma, Napa, Solano, and Santa Clara counties, and in the San Joaquin Valley. On the 27th a small portion of Fresno, Cal., was flooded, and the canals in that region overflowed, flooding large tracks of country.

**ATMOSPHERIC ELECTRICITY.****AURORAS.**

Yankton, S. Dak.: an almost perfect auroral corona was observed from 8 to 8.20 p. m., 11th. The beams, twelve in number, were of a white light and shot up from near the horizon to the zenith from all quarters of the sky except due south.

Northfield, Minn.: an aurora was observed at 4.35 a. m., 18th, eastern time. The display was evidently an extensive one, as the light was very bright in the horizon, and extended 45° east and west of the north point. A pall of black clouds hung like a curtain over the upper portion of the aurora.

Fort Buford, N. Dak.: an auroral band, in the form of an arch of light gray color, was observed at 10.30 p. m., 18th. At that time the arch had an altitude of 10°, and rose steadily until it reached altitude 20°, when it covered 65° of the horizon between northwest and northeast. The aurora continued into the night. A slight auroral light was observed on the 21st.

Fort Custer, Mont.: a faint aurora was visible in the north from 9.45 p. m. to 11.30 p. m., 20th. The display was in the form of a wavy curtain of a diffuse light which rose to altitude 12°, and extended from azimuth 180° to 216°.

Auroras were observed during the month as follows: 2d, Morris, Minn. 3d, Hess Road Station, N. Y. 11th, Yankton, S. Dak. 17th, Voluntown, Conn.; Davenport, Iowa; Cornish, Eastport, and Orono, Me.; Leicester and Newburyport, Mass.; New England City and Steele, N. Dak.; Scranton and Webster, S. Dak. 18th, Orono, Me.; Northfield, Minn.; Glendive, Mont.; Fort Buford and New England City, N. Dak.; Scranton, S. Dak. 20th, Fort Custer, Mont.; Egg Harbor City, N. J. 21st, Davenport and Wesley, Iowa; Orono, Me.; Moorhead, Minn.; Fort Buford, N. Dak. 23d, Morris, Minn. 28th,

Nashua, N. H. 30th, Era, Idaho. 31st, Morris, Minn.; North Hammond, N. Y.

**ZODIACAL LIGHT.**

Northfield, Minn., 20th: the zodiacal light is quite brilliant in the western sky at this season of the year. The light has a whitish color and extends half way from the horizon to the Pleiades, its shape being slightly parabolic, with the vertex in the sky, sloping off to the northward. It has been learned that at this season of the year the light is usually quite as brilliant as it is now, and attempts have been made to photograph it here.

**THUNDER-STORMS.**

No severe or destructive thunder-storms were reported during the month. East of the Rocky Mountains thunder-storms were reported in the greatest number of states and territories, eleven, on the 12th; in eight on the 1st, 2d, and 19th; in five on the 20th, and in from one to four, inclusive, on the 3d to 8th, 10th, 11th, 13th to 16th, 18th, 20th, 22d, 24th, 25th, 28th, 29th, and 31st. No thunder-storms were reported east of the Rocky Mountains on the 9th, 17th, 21st, 23d, 26th, 27th, and 30th.

East of the Rocky Mountains thunder-storms were reported on the greatest number of dates, nine, in Illinois; on eight in Louisiana and Tennessee; on seven in Arkansas, Kansas, and Texas; on from one to six, inclusive, in Alabama, Connecticut, Indiana, Indian Territory, Iowa, Kentucky, Mississippi, Missouri, New York, Ohio, Pennsylvania, and Vermont. In states and territories other than those named no thunder-storms were reported. The only states west of the Rocky Mountains reporting thunder-storms during the month were: California, on the 3d, 17th, 22d, 23d, and 24th; Montana, on the 1st and 29th, and Washington, on the 1st.

**MISCELLANEOUS PHENOMENA.****DROUGHT.**

Bermuda, Ala., 31st: owing to dry weather small streams in this section have become dry, which is an unusual occurrence at this season of the year.

Matanzas, Fla.: this month has been remarkable for long continued droughts. The orange crop has been damaged to a considerable extent.

**HALOS.**

Fort Custer, Mont., 14th: a brilliant solar halo of 22° radius was visible from soon after sunrise until 4 p. m. During a portion of the time, particularly about noon, a second halo of 46° radius was also visible. This halo was partial, the upper segment alone being visible; a parhelic circle passed through

both halos, causing bright parhelia at each point of intersection. A vertical column also passed through the sun, its appearance, with the parhelic circle, dividing the halo of 22° radius into four segments.

Solar and lunar halos were reported in the Atlantic coast states, mostly in New England and the middle Atlantic states, on twenty-two dates. On twenty-one dates rain or snow fell in that region on the dates for which the halos were reported; on twenty dates on the second day; and on eighteen dates on the third day following the halos. In the central valleys halos were reported, mostly north of the thirty-fifth parallel, for twenty-nine dates. On twenty-six dates rain or snow fell on the dates for which the halos were reported; on twenty-six dates on the second day; and on twenty-three dates on the

third day following the halos. In the Rocky Mountain and plateau regions halos were reported, mostly in the upper Missouri valley, on thirteen dates. On nine dates rain or snow fell on the same day; on six dates on the second day; and on one date on the third day following the halos. On the Pacific coast halos were reported, mostly on the north Pacific coast, on thirteen dates. On ten dates rain fell on the same day; on seven dates on the second day; and on five dates on the third day following the halos. The above statement shows that in the Atlantic coast states 96 per cent. of the halos were attended by rain or snow on the same date; that 90 per cent. were followed on the second date, and 82 per cent. on the third date by rain or snow. In the central valleys 90 per cent. of the halos were attended by rain or snow on the same date; 90 per cent. were followed on the second date; and 79 per cent. on the third date by rain or snow. In the Rocky Mountain and plateau regions 69 per cent. of the halos were attended by rain or snow on the same date; 46 per cent. were followed on the second date, and 8 per cent. on the third date by rain or snow. On the Pacific coast 77 per cent. of the halos were attended by rain or snow on the same date; 54 per cent. were followed on the second date, and 38 per cent. on the third date by rain or snow. It is also shown that in the Atlantic coast states 50 per cent. of the halos appeared in advance of low pressure storms, and 50 per cent. were reported following the passage of storm areas or within areas of high pressure. In the central valleys 38 per cent. of the halos appeared to the eastward of low pressure storms, and 62 per cent. were observed in the west quadrants of low pressure storms or within areas of high pressure. In the Rocky Mountain and plateau regions 46 per cent. of the halos appeared in the eastern quadrants, and 54 per cent. to the westward of low pressure storms. On the Pacific coast but 8 per cent. of the halos attended or preceded the approach of low pressure storms, while 92 per cent. were noted to the west or northwest of areas of low pressure.

It therefore appears that the halos of the current month generally occurred within the influence of low pressure storms; that in practically every instance rain or snow fell at or near the stations reporting halos on the date of their occurrence; that the rain or snow of the second and third dates following the halos attended the disturbed and humid condition of the atmosphere following general disturbances; and that the halos occurred most frequently in the west quadrants of areas of low pressure.

### METEORS.

Brilliant meteors were reported as follows: 8th, New London, Conn. 13th, Spearfish, S. Dak. 14th, Buffalo and Rochester, N. Y. 24th, Cumberland and Woodstock, Md. 25th, Galena, Md. Meteors were also reported on the 2d, at Clinton and Fayette, Iowa. 3d, Peoria, Ill. 8th, New London, Conn., and Sioux City, Iowa. 13th, Woodbury, N. J. 14th, Ithaca, N. Y., and Catawissa, Pa. 15th, Beverly, N. J. 18th, McCausland, Iowa, and Yellow Springs, Ohio. 20th, Dubuque, Iowa. 29th and 30th, Dale Enterprise, Va.

### MIRAGE.

Mirage were observed during the month as follows: 3d, Wahpeton, N. Dak. 7th, Tribune, Kans.; Wolsey, S. Dak. 9th, Woonsocket, S. Dak. 12th, Napoleon, N. Dak. 13th, Woonsocket, S. Dak. 17th, Sundance, Wyo. 18th, Hay Springs, Nebr. 23d, Tribune, Kans. 25th and 26th, Woonsocket, S. Dak. 27th, Napoleon, N. Dak.; Webster and Woonsocket, S. Dak. 28th and 29th, Tribune, Kans.; Woonsocket, S. Dak. 30th and 31st, Woonsocket, S. Dak.

Spearfish, S. Dak.: a very fine mirage occurred on the 5th, beginning about 8 a. m. and lasting nearly an hour. The ground west and northwest of Crow Peak, and between this place and Beulah, seemed to be lifted hundreds of feet above all the intervening high land which ordinarily shuts them off from view, and every belt of timber, ravine, or gulch, the course of the Redwater for miles, and even the ranches with smoke ascending from dwellings, were plainly seen.

Wolsey, S. Dak.: on the 25th, at 3 p. m., and on the 28th, from 8 a. m. to 10 a. m., unusually bright and distinct mirage were seen. The country for fifteen to twenty miles in every direction was plainly presented to view, and a freight train of ten cars, twelve miles distant could be seen.

### SUN SPOTS.

Haverford College Observatory, Pa. (observed by Prof. F. P. Leavenworth):

Date.	Number of new		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Faculae.	Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.		
Jan., 1890.										
3, 11 a. m. ...	0	0	0	0	0	0	1	1	0	Definition poor.
4, 11 a. m. ...	0	0	0	0	0	0	1	1	0	Definition poor.
6, 11 a. m. ...	0	0	0	0	0	0	1	1	0	Definition very poor.
8, 11 a. m. ...	0	0	0	0	0	0	1	1	0	Definition poor.
9, 10 a. m. ...	1	7	3	3	0	0	1	2	0	Definition very poor.
11, 3 p. m. ...	0	0	0	0	0	0	0	0	2	Definition good.
12, 3 p. m. ...	2	3	0	0	0	0	2	3	2	Definition fine, spots small.
13, 3 p. m. ...	0	0	0	0	0	0	0	0	2	Definition fair.
14, 11 a. m. ...	0	0	0	0	0	0	0	0	0	Definition poor.
16, 2 p. m. ...	1	0	0	0	0	0	1	0	0	Definition fair, spots small.
17, 10 a. m. ...	0	0	0	0	0	0	1	8	3	Definition good.
18, 12 m. ...	0	0	0	0	0	0	1	14	1	Definition fine.
19, 11 a. m. ...	0	10	0	0	0	0	1	24	0	Definition fine, 2 large spots.
21, 1 p. m. ...	0	0	0	0	0	0	1	0	1	Definition good, 1 large spot.
22, 11 a. m. ...	0	0	0	0	0	0	1	2	1	Definition poor.
24, 9 a. m. ...	0	0	1	2	0	0	0	0	4	Definition poor.
25, 2 p. m. ...	0	0	0	0	0	0	0	0	0	Definition very poor.
27, 9 a. m. ...	0	0	0	0	0	0	0	0	3	Definition poor.
28, 10 a. m. ...	0	0	0	0	0	0	0	0	3	Definition poor.
29, 10 a. m. ...	0	0	0	0	0	0	0	0	0	Definition poor.
30, 11 a. m. ...	1	4	0	0	0	0	1	4	1	Definition good.

Mr. C. E. Buzzell, Leaf River, Ill.: the group of December 27th was observed January 2d and 3d. Clouds, 4th to 7th. 9th, two small spots observed in high latitude one day past meridian. Clouds, 10th, 11th, 12th. 16th, one small spot in low latitude one day west of meridian, increasing on 18th and forming three groups on 20th; passed west limb 21st. Clouds, 22d to 26th. 30th, small group one day in on east limb, increasing to two groups on 31st, and subsiding to one small group on February 1st.

Mr. John W. James, Riley, Ill.: a large single spot on the sun's meridian 1st to 2d; disappeared by solar rotation, 7th or 8th. None seen the rest of the month.

Mr. M. A. Vedder, Lyons, N. Y.: the large spot that appeared by rotation on December, 26th was seen nearing the western limb on January 4th. On January 20th and 21st two large spots were seen close to the western limb; this disturbance probably appeared by rotation on January 9th, spots forming during the transit. Faint groups of faculae were seen near the eastern limb on January 14th and 28th. Observations were poor or lacking on nearly all other days.

Mr. H. D. Govey, North Lewisburgh, Ohio: sun spots 3d, 21st.

### VERIFICATIONS.

#### FORECASTS FOR 24 HOURS IN ADVANCE.

[Verifications made by Assistant Professor C. F. Marvin, assisted by Mr. H. E. Williams, chief clerk of the Forecast Division.]

The forecasts for districts east of the Rocky Mountains for

January, 1890, were made by Captain H. H. O. Dunwoody, 4th Artillery, Signal Officer, and those for the Pacific coast districts were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps.